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Announcements by the Council.

EXAMINATIONS, 1865.

The Prcgramme of Examinations for 1865 is now ready, and may be had gratis on application to the Secretary. A copy has been sent to each Institution and Local Board.

Proceedings of the Society.

CANTOR LECTURES.

"On Chemistry Applied to the Arts." By Dr. F. Crace Calvert, F.R.S., F.C.S.

Lecture V.*

Delivered on Thursday Evening, May 5, 1864.

Bile, its properties. *Blood*, its composition, and application in the refining of sugar and manufacture of albumen. *Albumen*, its application to calico-printing and photography. *Milk*, its composition, properties, falsification, and preservation. *Urine*, its uses. A few words on putrefaction.

In this lecture we shall examine the composition of the various liquids secreted in the human body and in those of animals, and the uses to which these fluids are applied in arts and manufactures.

Bile.—The composition and appearance of bile vary greatly in different animals. Usually it is a yellow, green, or brown, thick fluid, with a marked alkaline reaction, and containing about 14 per cent. of solid matter, the most important constituents of which are, in human bile, mucus, two colouring matters, one yellow, (*cholepyrrhine*) the other green (*biliverdine*), sugar, albumen, two organic acids (*cholic and choleic*), combined with soda, oleate and margarate of soda, a non-saponifiable fatty matter (*cholesterine*), and several mineral salts. The two most interesting substances in bile are choleic acid and cholestérine, which, when produced in undue proportion, give rise to those calculi, the passage of which through the biliary duct is so dangerous and painful. One of the most valuable papers published of late is that of Mr. G. Kemp, in the Transactions of the Royal Society, on the conversion of the hepatic bile into cestic,—thus he has shown that as the former is secreted by the liver, and arrives by the biliary duct in the gall bladder, it is there converted into cestic bile by means of a special fermentation, induced by a mucus secreted in the walls of the gall bladder. It is believed by most physiologists that the principal function of bile is to neutralize the acid fluids resulting from digestion in the stomach, as they enter the small intestines, rendering them better adapted for their sojourn there, and also facilitating their fermentation, one of the most important phenomena of digestion. The employment of bile as a scouring agent has much diminished of late years, owing to the substitution for it of benzine and Sherwood spirit.

Blood.—The study of this all-important fluid is most interesting, in a physiological point of view, for the 27 pounds of blood (the average amount in an adult) which travels through the whole of the human frame in about three minutes, fulfils three distinct functions, viz.,—it carries the various elements of food, as modified by digestion, into the different parts of the body requiring them; it helps to remove from the system those substances which have fulfilled their required functions in it, and which have been rendered useless by the wear and tear of life; and it conveys through the system the heat generated by the oxidation, through respiration, of the substances which have been absorbed during digestion, as well as of those which have performed their part in the human economy, and require to be removed therefrom. It will, therefore, be easily understood that blood must be a complicated fluid; and the following table will give an idea of the truth of this assertion:—

1,000 parts of Blood.

130·85 of clot	Fibrine	2·95	130·85
	Globules	125·63	
	Hematosine	2·27	
869·15 of serum.	Water	790·37	869·15
	Albumen, Soda	67·80	
	Phosphate of Soda	10·98	
	Lactate of do.		
	Carbonate of do.		
	Chloride of Sodium		
	,, of Potassium		
	Carbonate of Lime		
	,, of Magnesia		
	Ammoniacal Salts		
	Phosphate of Lime		
	,, of Magnesia		
	Sulphate of Potash		
	Fatty Acids, free or combined		
	Cholesterine		
	Lecithine (phosphurretted fat)		
	Ceribrine, or nitrogenated fat		
1000·00			1000·00

* This lecture was No. VI. when the Course was delivered, but the present order of publication has been adopted, as bringing the whole subject more systematically before the reader.

It will facilitate our study of this complicated fluid if we class the various compounds existing in it under six different heads. Firstly, if blood, immediately after being drawn from an animal, is whipped with a birch-rod, the ends of the twigs will have hanging from them a stringy mass, which, after being well washed, is grey and elastic, and is called *fibrine*. Secondly, if the blood so treated is mixed with a solution of sulphate of soda of sp. gr. 1·16, and the whole thrown on a filter, the *corpuscules* and the colouring matter called *hematosine*, will remain on the filter, and these substances, with the fibrine, form, as shown in the table, the clot of blood. Further, if the matter left on the filter is treated with concentrated acetic acid, the colouring matter is dissolved and the corpuscules are left as yellow discs. Thirdly, on boiling the fluid which passes through the filter, albumen is coagulated and can be easily separated, leaving water and a few saline substances, which are easily separated by evaporating the liquid portion. Allow me now to add a few remarks on some of the substances above mentioned. Fibrine represents the fibrous or muscular part of animals, but has no direct application in manufactures. The blood corpuscules in man are ellipsoid discs, containing the colouring matter of blood. The most interesting fact connected with the latter is that it is united with a compound containing iron; and although iron does not appear to be an integral part of the colour, still its presence appears essential to the existence of the colour itself. The external part of the discs is composed of fibrine, whilst the interior contains an albuminous fluid (which differs from the albumen of the serum in the fact that it is not coagulated by heat) and which is called globuline. The relative proportions of fibrine, globuline, and hematosine, vary considerably in different individuals, according to health, age, and sex, and even during the process of digestion. When blood is examined under the microscope, large colourless globules are found to float with those just described. Dr. William Roberts, of Manchester, who has examined the corpuscules of blood, has observed that when they are dipped into a solution of magenta, they assume not only a pink colour, but that the nucleus of the disc acquires a much deeper shade. Further, that on the sides of the disc there are small projections which he calls pullulations, and which acquire a much deeper tint than the remainder of the discs when plunged into the magenta solution. Another curious fact lately observed by M. Pasteur is that if blood is kept for several weeks in a cold situation, air being excluded, the corpuscules disappear, and are replaced by myriads of beautiful red well-defined crystals. Lastly, there is a slight difference of composition between arterial and venous blood.

	Arterial.	Venous.
Carbon	50·2	55·7
Nitrogen	16·3	16·2
Hydrogen	6·6	6·4
Oxygen	26·3	21·7
	99·4	100·0

It is strange that while blood is so extensively employed on the Continent in various branches of manufacture that in Paris 2,000 tons of blood are used by sugar refiners alone, hardly any such application of this fluid is made in our own country. It appears to me that the explanation is to be found in the fact that on the Continent beasts are generally slaughtered in public abattoirs, by which means many of the refuse matters can be collected with advantage, and without being spoilt or polluted by unscrupulous persons, whilst in this country, where animals are slaughtered in innumerable private slaughter-houses, the difficulty and expense of collection, together with the absence of guarantee of quality, render the successful use of blood on a large scale impracticable. There is an additional advantage in the system of public abattoirs, which I cannot help noticing *en passant*, viz., the guarantee thereby obtained that the public food is not furnished from diseased animals. The only employment of blood in its integrity in this country is as an article of diet, and to some extent in the manufacture of prussiate of potash. The serum of blood is sometimes used in England, as well as on the Continent, as one of the substances essential in the process followed to communicate to cotton the magnificent colour called "Turkey red."

Albumen (blood).—The employment of this substance in the art of calico printing is of comparatively recent date, as it is chiefly due to the introduction of the tar colours and pigment styles into that art. To fix colours with this albumen (or that of egg) it is only necessary to dissolve in a gallon of water several pounds of albumen and gum Senegal, adding a little tar colour, such as magenta, &c., or a pigment, such as ultramarine blue, these mixtures are then printed on the cotton fabric, and the colour fixed by the coagulation of the albumen under the influence of high pressure steam. But the quantity of albumen used for this purpose has greatly decreased of late years, owing to the introduction of tannin by Mr. Charles Lowe and myself, Messrs. Roberts, Dale, and Co., and Mr. Gratrix, and also that of the arseniate of alumina by Mr. W. A. Perkin. The substitution of blood albumen for that of egg is chiefly due to Messrs. Rohart, Roger, and Co., who, I believe, prepare it by separating carefully the serum of blood from the clot, adding to it a small quantity of alum to separate any colouring matter that may be mixed with it, and evaporating the water of the serum by a current of air heated to 100°, which leaves the albumen in the form of yellowish scales, freely soluble when placed again in contact with water. The most abundant source of albumen, however, is the white of egg, and therefore let us glance at a few facts connected with this substance, doubly important as an article of manufacture, and as one of food. To give some idea of the extensive use of eggs, I may state that in Paris there are annually consumed 178,000 000 eggs, weighing 28,000,000 pounds. The composition of a hen's egg may be stated to be as follows:—

Shell	11·5
White	58·5
Yolk	30·0
	100·0

The following are the respective compositions of the yolk and white:—

Yolk.		White.	
Water	51·47	Water	86.34
Vitelline	15·76	Albumen	12·50
Oleine, Margarine, Cholesterine	28·97	Membrane	0·50
Phospho-glyceric acid	1·26	Phosphates, Chlorides, &c.	0·66
Colouring matters	1·20		100·00
Mineral salts	1.34		
	100·00		

An egg may be considered as consisting of four parts, the shell, membrane, white, and yolk. The shell is composed of carbonates of lime and magnesia, phosphate of lime, and oxide of iron, the whole bound together by a nitro-sulphuretted substance. The presence of sulphur in this substance, as well as in albumen, explains why eggs give off sulphuretted hydrogen when boiled. The membrane lining the shell is also a nitrosulphuretted substance, much resembling in its composition that of horn. I have already had occasion to speak of the interesting composition of the yolk of egg, when mentioning its application in the glove manufacture, and on that occasion I drew your attention to the remarkable substance called vitelline, and to the peculiar nature of the fats contained in yolk of eggs, but more especially the phospho-glyceric acid, attributing to them the peculiar properties imparted to leather through their use. The white of egg chiefly consists, as the above table shows, of a substance called

albumen, which you will remember is also found in blood, and, I may add, that it exists in the sap of all plants. Albumen is a fluid of an alkaline reaction, soluble in water; and cogulates at 160° when undiluted, but when dissolved in water the temperature at which it coagulates is raised according to the extent of its dilution. Albumen gives a precipitate with all metallic salts, but one of the most characteristic and delicate tests for albumen in solution, is bichloride of mercury or corrosive sublimate. In fact, albumen is the best antidote known to the action of this violent poison, when taken internally, as was proved by its saving the life of a most eminent chemist (Baron Thenard) in 1825. All acids, except phosphoric and acetic, precipitate albumen from its solutions, but that which separates it with the greatest nicety is nitric acid When placed in contact with hydrochloric acid for a few hours, it assumes a very beautiful purple colour. When albumen is placed in shallow vessels, and then stored in a chamber where air at 100° is allowed to circulate, the water evaporates and leaves the solid albumen in the form of yellowish semi-transparent scales, which, strange to say, will, if kept dry, resist putrefaction for any length of time, although in its liquid form the large amount of nitrogen it contains renders it highly putrescible. It is this solid albumen which is used by calico printers, as it is easily dissolved in water and rendered applicable to their purposes. Albumen is often used in manufactures to clarify fluids. In some instances the albumen in solution is added to the fluid and carried to the boil, when the dissolved albumen coagulates, and in falling through the fluid carries with it mechanically the matters in suspension, when it is only necessary to decant the clarified fluid. In others it is added at natural temperature, as in the case of wines, where the tannin, alcohol, and acids are the agents which coagulate the albumen. Albumen was first applied to photography by Niepce de St. Victor, in the following form: he mixed together intimately 10 fluid ounces of distilled water with the white of 10 fresh eggs; to this he added 200 grains of chloride of sodium or chloride of ammonium. The whole was well shaken in a bottle for about ten minutes, and then allowed to stand. All that was then required was to decant the clear liquor, and apply it to the surfaces intended to receive the photographic image. [Here the lecturer shortly described this photographic process, and alluded to the recent application of the light resulting from the combustion of magnesium wire, manufactured by Messrs. J. Mellor and Co., of Salford, showing its applicability to photography, by using this light to take photographs during the lecture, stating that the cost was only a few pence.] A great many attempts have been made to preserve eggs from decay, the most successful of which have been those of La Maison Cormier du Mans, who covers the egg with an impermeable varnish, packing them in sawdust, so that the egg shall always rest on one end. Another process is that of immersing the eggs in limewater. Lastly, the whole of the egg has been emptied out of the shell and evaporated to a solid mass. I must not conclude the subject of the albuminous and vitelline substances without calling your attention to the following table, which will give an idea of the different albumens and vitellines which Mr. E. Fremy has succeeded in isolating and characterising:—

Eggs of Birds.

Albumen	coagulated by heat	All these substances are characterised by containing sulphur.
Eudophacine	" "	
Albumen	" acid	
Meta albumen	" neither	
Exophacine	" "	

Eggs of Fishes.

Ray	Ichthine	All these substances are characterised by containing phosphorus.
Goldfish, Carp	Ichthidine	
Salmon	Ichthuline and Salmonic acid.	
Turtle	Eurydine.	

Milk.—The composition of this important fluid varies not only in different classes of animals, but also in different individuals of the same class. Further, the composition of milk is modified by the influence of food, climate, degree of activity, and health. Notwithstanding these variations an average can be arrived at by numerous analyses, and the following table will give a general idea of milk:—

	Woman's.	Cows'.	Asses'.	Goats'.	Ewes'.
Dried Caseine...	15·2	44·8	18·2	40·2	45·8
Butter	33·5	31·3	1·1	33·2	12·0
Sugar of Milk...	65 0	47·7	60·8	52·8	50·0
Salts	4·5	6·0	3·4	5·8	6·8
Water	881·8	870·2	916·5	868·0	885·4
	1000·0	1000·0	1000·0	1000·0	1000·0

The various substances comprised in milk may be classified under three heads—cream, curd or caseine, and whey.

Cream, according to Dr. Voelcker's* analysis, is composed of:—

Water	61·67	64·80
Butter	33·43	25 40
Caseine	2·62	7·61
Sugar of milk	1·56	
Mineral matters ...	0·72	2·19
	100·00	100·00

And may be considered as consisting of small, round, egg-shaped globules, composed of fatty matters, enclosed in a thin cell of caseine, which, being lighter than the fluid containing them, rise to the surface and constitute cream, and in proportion to the quantity of this removed from the milk, the latter becomes less opaque, and assumes a blue tinge. When exposed to the air for a short time in a dry place it loses water, becomes more compact, and constitutes what is called cream cheese. When churned, cream undergoes a compl te change; the caseine cells are broken, and the fatty globules gradually adhere one to the other and form a solid fatty mass, called butter, and it is found, on an average, that 28lbs. of milk will yield one pound of butter. Fresh butter is composed of:—

Fatty matters...	Margarine, Ol·ine, Caproine, Caprine, Butyrine, Caproleine,	77·5
Caseine		1·6
Whey		20·9
		100·0

But as butter rapidly becomes rancid, it is necessary to adopt means to prevent this as much as possible, and the following are the usual methods, viz.—working the butter well with water, and then adding 3 or 4 per cent. of common salt, or, melting the butter at a temperature below 212°; but the following method, employed by M. Bréon, appears to give general satisfaction. It consists in adding to the butter, water containing 0·003 of acetic or tartaric acid, and carefully closing the vessels containing it. The rancidity of butter is due to a fermentation generated by the caseine existing in it, which unfolds the fatty matters into their respective acids and glycerine, and as the volatile acids, butyric, caproic, &c., have a most disagreeable taste and odour, it is these which impart to butter the rank taste. Allow me to add,

* For further particulars on this subject the reader is referred Dr. Voelcker's paper, published in the *Journal of the Royal Agricultural Society of England*, volume 24.

en passant, that whilst butyric acid possesses a repulsive smell, its ether has a most flagrant odour, viz., that of pine-apple, for which it is sold in commerce.

Curd of Milk or Caseine has, according to Dr. Voeleker, the following composition:—

Carbon	53·57
Hydrogen	7·14
Nitrogen	15·41
Oxygen	22·03
Sulphur	1·11
Phosphorus	0·74
Total	100·00

And is easily recognisable by its white flocculent appearance. It is insipid and inodorous, like albumen, from which it differs in its insolubility in water, though it is dissolved by a weak solution of alkali or acid. But what chiefly distinguishes caseine is that it is not coagulated on boiling, and that rennet precipitates it from its solutions. Dr. Voelcker has proved, however, in his researches on cheese, that the commonly-received opinion, that rennet coagulates milk by decomposing the lactine into lactic acid, is incorrect, for he has coagulated milk while in an alkaline condition, and it is owing to the difference in the action of rennet on albumen and caseine, that chemists have been able to detect the presence of $\frac{1}{2}$ to $\frac{3}{4}$ per cent. of albumen in milk. This important organic substance not only exists in milk, but is also found in small quantities in the blood of some animals, such as the ox, and in a large class of plants, but more especially in the leguminous tribe, such as peas, beans, &c. Caseine is the basis of all cheeses, and when these are made with milk from which the cream has been previously taken, the cheese is dry, but when part of the cream has been left the cheese is rich in fatty matters as well as in caseine; and I may add that the peculiar flavours characterising different cheeses are caused by modifying the conditions of the fermentations which the organic matters undergo. The following researches made by M. Blondeau illustrate this point, as well as the modifications which cryptogamic life under peculiar circumstances may effect in the composition of organic substances, and his interesting results were obtained in studying the conversion of curd into the well-known cheese of Roquefort. He placed in a cellar some curd of the following composition:—

Caseine	85·43
Fatty matters	1·85
Lactic acid	0·88
Water	11·84
	100·00

to which he added a small quantity of salt. After a month, and again after two months, he analysed portions of the same, with the following results:—

	After 1 month.	After 2 months.
Caseine	61·33	43·28
Fatty matters	16·12	32·31
Chloride of Sodium	4·40	4·45
Water	18·15	19·16
Butyric acid	....	0·67
	100·00	99·87

The above figures show a most extraordinary change in the caseine or curd, for we observe that the proportion of caseine gradually decreases, and is replaced by fatty matters. Considering the circumstances under which this phenomenon has occurred, there can be no doubt that this curious conversion of an animal matter into a fatty one is due to a cryptogamic vegetation or ferment; and if the Roquefort cheese be exposed to the air under a bell jar for 12 months, the decomposition becomes still more complete; for it is no longer the caseine which undergoes a transformation, but the oleine of the fatty matters. The following analyses clearly illustrate this curious action. Composition of the cheese after 2 and 12 months:—

	After 2 months.	After 12 months.
Caseine	43·28	40·23
Margarine	18·30	16·85
Oleine	14·00	1·48
Butyric acid	0·67	....
Common salt	4·45	4·45
Water	19·30	15·16
Butyrate of ammonia	....	5·62
Caproate of ammonia	....	7·31
Caprylate of ammonia	....	4·18
Caprate of ammonia	....	4·21
	100·00	99·49

The substances to which cheeses owe their peculiar flavour are ammoniacal salts, chiefly composed of various organic acids, such as acetic, butyric, capric, caproic, and caproleic. I cannot better conclude my remarks on cheese than by extracting from Dr. Voelcker's interesting papers a few of his numerous analyses of different kinds of cheese:—

	Cheshire.	Stilton.	Old Cheddar.	Double Gloster.	Single Gloster.	American
Water	32·59	20·27	30·32	32·44	28·10	27·29
Butter	32·51	43·98	35·53	30·17	33·68	35·41
†Caseine	26·06	} 33·55	28·18	31·75	30·31	25·87
Sugar of milk } Lactic acid	4·53		1·66	1·22	3·72	6·21
†Mineral matter	4·31	2·20	4·31	4·42	4·19	5·22
	100·00	100·00	100·00	100·00	100·00	100·00
†Nitrogen	4·17	3·89	4·51	5·12	4·85	4·14
†Common salt	1·59	0·29	1·55	1·41	1·12	1·97

The principal application of caseine in arts and manufactures is that first introduced by Mr. R. T. Pattison, who used it under the name of lactarine for fixing pigments in calico printing. His process consists in drying the washed curds of milk, which he sells to the calico printer, who mixes it with a solution of ammonia or weak alkali which swells it out and renders it soluble in water. To a solution of this substance, of proper consistency, he adds one of the tar colours, prints it, submits the goods to the action of steam, which drives off the ammonia, leaving fixed on the fabric the caseine and colour. In consequence of the insoluble compound which caseine forms with lime it has often been used as a substitute for glue or linseed oil in house painting, and it may be useful to some of my audience to know that when caseine is dissolved in a concentrated solution of borax, an adhesive fluid is formed, which is capable in many cases of serving the purposes of glue or starch. Mr. Wagner has made another useful application of caseine, mixing it with 6 parts of calcined magnesia and one part of oxide of zinc, and a sufficient quantity of water to make a pasty mass, which he leaves to solidify, and when dry it is extremely hard, susceptible of receiving a high polish, and is sold as a substitute for meerschaum.

Whey.—According to Dr. Voelcker, the composition of whey is as follows:—

Water	89·65
Butter	0·79
Caseine	3·01
Sugar of Milk	5·72
Mineral Matters	0·83
	100·00

When whey is concentrated to the state of syrup, and kept in a cold place, it gradually deposits fine well-defined crystals, which, on further purification and re-crystallisation, yield white quadrangular prisms of a substance, called lactine, or sugar of milk, which is highly interest-

ing. It is remarkable that while sugar of milk has only been known in Europe for a comparatively short period, where homœopathists are its principal employers, in India lactine has been known for a great number of years. Let us now study some of the chemical facts connected with sugar of milk. Thus cane sugar, when acted upon by nitric acid, gives oxalic acid, whilst lactine gives mucic acid; cane sugar, when unfolded under the influence of a ferment, gives alcohol and carbonic acid; lactine yields lactic acid. As the latter transformation is most important, in a physiological and chemical point of view, allow me to dwell upon it for a few minutes. The substance which possesses the property of most readily converting lactine into lactic acid, is caseine after it has undergone some peculiar modification, which renders it a ferment. Thus when milk leaves the cow it is alkaline, but when exposed to the air it rapidly becomes acid, and this is due to the conversion of lactine into lactic acid, a change most interesting as a chemical fact, since both lactine and lactic acid have the same composition, the only difference being that two equivalents of oxygen and two of hydrogen cease to exist as such in the acid, but may be considered as combined in the form of water with the remaining elements—

Lactine	C_{12}	H_{12}	O_{12}	
2 Lactic acid......	$(C_6$	H_5	O_5	$HO)$

M. Pasteur has shown that this lactic fermentation is not merely confined to milk, but that it is a peculiar fermentation, differing from the previous one, which frequently occurs during the decomposition of organic matters, and is due to a distinct ferment of its own; and his researches on lactic fermentation have explained the fact, observed by M. Pelouze, some years since, that when a vegetable substance, such as sugar or starch, was put in contact with chalk or other alkali and an animal substance, lactic fermentation ensued, but until the researches of M. Pasteur, we did not know why sugar and starch, in these circumstances, should give lactic acid instead of alcohol and carbonic acid, which would be the result of a fermentation produced by yeast. Lactic acid is a most interesting substance to the physiologist, for it is found in large quantities, free or combined with lime, in gastric juice, in the muscular part of animals, or with soda, in blood, and its production is easily accounted for when we remember that it can be produced from the starch and sugar existing in our food. When lactic acid is purified by various chemical means and separated from the fluid in which it is combined, it presents itself as a syrupy fluid, of an intensely acid reaction, which, when submitted to the action of heat, first loses its one equivalent of water, and becomes anhydrous lactic acid, and on a further application of heat loses still one equivalent of water, and is transformed into a neutral substance called lactide. This acid, in a free state, has not yet received any important application in arts and manufactures, but I have little doubt that it will some day be largely employed, for we have noticed in a former lecture its advantageous use when produced from rye and other amylaceous substances in removing the lime from various skins intended to be tanned or prepared as there described, and Mr. E. Hunt has used it in the form of sour milk for the conversion of starch into dextrine (see *Journal of the Society of Arts*, December 23rd, 1859). I wish now to say a few words on the mineral substances existing in whey, and which play a most important part in milk as a nutritious substance. We are all of us too apt to overlook the importance of the mineral elements in food, and to consider as essential the organic matters only. In milk, however, its alkaline salts, and especially the phosphate of lime, are as essential (as food) as caseine or fatty matters, for if an infant requires the lactine to maintain respiration and the heat of the body, the caseine to contribute to the formation of blood, the phosphate of lime is equally essential to the production of bone; permit me here to state that the practice adopted by some mothers of feeding infants upon amylaceous substances, such as arrowroot, sago, tapioca, &c., in place of milk, is most pernicious, for these contain neither flesh nor bone forming element, and milk is the only proper food for infants.

Having now examined the general properties of some of the most important constituents of milk, let us say a few words on that fluid in its integrity. We all know how rapidly milk becomes sour, especially at a temperature of 70° to 90°, and as this is owing, as already explained, to the formation of lactic acid, the best way to preserve milk sweet for domestic purposes is to add to it every day a few grains per pint of carbonate of soda, to keep the milk alkaline. The possibility of preserving milk for a lengthened period has repeatedly occupied the attention of scientific men, as a most important problem to solve for the benefit of persons undergoing long sea-voyages, but up to a recent date with very imperfect success. One of the best plans proposed is to add to milk seven or eight per cent. of sugar, and evaporate the whole, agitating all the time to prevent the formation of the skin, and when reduced to one-fifth of its bulk to introduce it into tin cans, which, after being subjected for half an hour to a temperature of 220°, are hermetically sealed. In 1855, l'Abbé Moigno drew the attention of the members of the British Association at Glasgow to milk, which he stated contained nothing injurious, and which would keep for a long period. This statement has proved correct, for I have here some milk which has been in the hands of the secretary of this Society since that period, and which, on being opened to day, was found perfectly sweet. But if l'Abbé Moigno's process has remained a secret, M. Pasteur has succeeded in effecting the same end, and probably by the same method. Thus he has found that if milk be heated to 212° it will only remain sweet for a few days, if heated to 220° it will remain sweet for several weeks, but if to 250° (under pressure, of course) the milk will keep for any length of time. This, according to M. Pasteur, is owing to the spores or eggs which generate lactic fermentation being destroyed by the high temperature, and thus the possibility of fermentation is put an end to. The adulteration of milk by various substances stated to have been discovered therein, has, I think, been greatly overestimated, as I have never found any of them in the samples of milk which I have analysed, in fact the most easy and cheapest of all is the addition of water. It is comparatively easy to ascertain if milk has been tampered with; but, without entering into details of the methods necessary to estimate the exact extent of adulteration, I may mention the following plan:—If a glass tube, divided into 100 equal parts, is filled with milk and left standing for twenty-four hours, the cream will rise to the upper part of the tube, and, if the milk is genuine, will occupy from 11 to 13 divisions. Another practical method is to add to the milk a little caustic soda, and agitate the whole with a little ether and alcohol, which dissolves the fatty matters; this ethereal solution is removed from the milk and evaporated, when the fatty matters remain, and experience has shown that 1,000 parts of good milk will yield 37 parts of fatty matters. Any milk leaving no more than 27 must have been tampered with. Dr. Voelcker suggests the employment of a hydrometer as a means of ascertaining the quality of milk, as the specific gravity of that fluid is an excellent test. From a great number of experiments he has ascertained that good new milk has a sp. gr. of 1·030, whilst if good milk is adulterated with 20 per cent. of water, its sp. gr. will fall to 1·025.

Urine is a fluid secreted by the kidneys, which organs separate from the blood as it circulates through them any excess of water it may contain, as well as many organic substances which have fulfilled their vital function in the animal economy, and which require to be removed from the system. The composition of urine varies greatly in different individuals, and in the same individual at different times, and is influenced by diet, exercise, state of

health, &c., as shown by Dr. Bence Jones and Dr. Edward Smith, but without detailing these variations, which would occupy far more time than the limits of a lecture would permit, allow me to call your attention to the following table, showing the composition of human and herbivorous animals' urine :—

HUMAN.

Water	933·000
Urea	30·100
Lactic acid, Laetate of ammonia, Extractive matter, Kreatine, Kreatinine, Hippuric acid, Indican, Colloid acid (W. Marcet)	17·140
Uric acid	1·000
Mucus	0 320
Mineral salts	18·440
	1000·000

HORSES.

Water	910·76
Urea	31·00
Hippurate of potash	4·74
Lactate of do.	11·28
Do. of soda	8·81
Bicarbonate of potash	15·50
Carbonate of lime	10·82
Carbonate of magnesia	4·16
Other salts	2·93
	1000·00

The substances in human urine which call for special notice are urea and uric acid; in herbivorous animals, hippuric acid; and in birds, uric acid.

Urea is a substance crystallizing in various derivative forms belonging to the prismatic system—it is very soluble in water and alcohol, and gives beautiful and well-defined salts with nitric and oxalic acids. Urea, under the influence of a mucous substance secreted at the same time, and which is easily modified into a ferment, is rapidly converted, by the fixation of two atoms of water, into carbonate of ammonia, as seen by this formula :—

Urea	C_2	O_2	N_2	H_4
Water		O_2		H_2
Carbonate of Ammonia	C_2	O_4	N_2	H_6

This will explain the strong ammoniacal odour arising from urine after being kept for a short time; and as it may be most important for medical men to be able to preserve urine in its normal condition for several days, I observed a few years since a most effectual method of preserving it, which is merely the addition of a few drops of carbolic acid immediately after the production of the urine. Urea is peculiarly interesting to chemists, as it was the first organic substance which they succeeded in producing artificially from mineral compounds. This interesting discovery was made by Wöhler, in 1820, in acting upon cyanate of silver by hydrochlorate of ammonia. Since then Baron Liebig has devised a more simple process, which consists in decomposing cyanate of potash by sulphate of ammonia, which gives rise to sulphate of potash and cyanate of ammonia or urea. The average quantity of urea rejected daily by an adult man is about an ounce, or 2½ per cent. of the fluid itself. Although human urine does not contain more than 1 per cent. of uric acid, and this generally combined with soda, still I deem it my duty to say a few words respecting it, for it is often the principal source of gravel and calculus, owing to various influences which make the urine strongly acid before its rejection, whereby the soda is neutralized, the uric acid liberated, and this being nearly insoluble, separates, and has a tendency to form gravel or calculus. In fact, the deposit which occurs in this fluid is generally represented by uric acid, phosphate of lime, and magnesia, mucus, and colouring matter. It may be here stated that calculi were formerly held in great estimation, especially those formed in the intestine, and called bezoards, and this was the case in Eastern counties until very recently. Thus it is related that a Shah of Persia sent to Napoleon the the First, among other valuable presents, three bezoards, which were considered to be of great antiquity, and capable of curing all diseases. The urine of birds and reptiles being almost entirely composed of urate of lime, explains why their refuse is of such value as a manure, which arises from its transformation into carbonate of ammonia. When large masses of this refuse undergo a slow and gradual decomposition, as in the dry climate of the Pacific Islands, on the coasts of Peru and Chili, it constitutes guano. It may be interesting to know that in 1855, 6, and 7, a most beautiful colour was prepared from the uric acid contained in guano, and used largely by calico printers and silk dyers under the name of Roman purple, or murexide.*

Before leaving the study of this important animal secretion, let me say a few words on the urine of herbivorous animals. It is generally alkaline, and contains, besides an aromatic principle, an acid discovered by Liebig, and called hippuric acid, together with urea and uric acid, also found in human urine. Hippuric acid is easily obtained in the form of well defined crystals, by rapidly evaporating the fluid containing it. This acid does not exist in the food of the animal; but benzoic acid, or its homologues are found there, and during the phenomena of digestion the nitrogenated principles produced by the wear and tear of life, fix themselves on the benzoic acid, and convert it into hippuric, as seen by this formula :—

$$\underset{\text{Benzoic Acid.}}{C_{14}H_5O_3} + HO. \;\ldots\ldots\; \underset{\text{Hippuric Acid.}}{C_{18}H_8O_5N_2} + HO.$$

A further proof of the correctness of this view is that when hippuric acid is treated with strong acids or alkali, it transforms itself into benzoic acid, which can be easily extracted.

PATENT LAWS.

The following letter, from Mr. Edmund Pontifex, recently addressed to the editor of the *Times*, with the reply in a leader from that journal, contain in a convenient form the principal arguments on each side of this question :—

"In your Saturday's article on Lord Stanley's speech you object to the conclusions he appears to have arrived at with regard to the Patent Laws, and assert that the true way of dealing with the inventor is to let him reward himself; that if the Patent Laws were abolished to-morrow he would still have his priority, his secret; that if he can keep his secret he may derive from it what advantage he can, but that, if publication be a necessary consequence of its use, the public should not be called upon to pay for what is in its nature incapable of appropriation.

"It is difficult to see in what respect the publication of a new or improved process of manufacture renders it more 'incapable of appropriation' than the publication of ideas in the form of a book. Patent right corresponds to copyright. One protects the development of thought in words, the other in that of facts, and being the more practical, it has, perhaps, the better claim of the two. Indeed, the present Patent Laws admit this principle, for they deny that protection to abstract ideas which they afford them when reduced to a practical application.

"If, then, protection is denied to the inventor, how can it be claimed for the author? The artist and designer

* See, for further details, the paper read by Dr. Calvert before the Society, February 5th, 1862.—*Journal*, vol. x., p. 169.

also stand on the same footing as the inventor, and it would scarcely be suggested so greatly to discourage art as to abolish the copyright in pictures and designs.

"The Patent Laws are no doubt capable of much improvement. If it were practicable it would undoubtedly be a great advantage for a tribunal of experts to decide whether or not suggested inventions or improvements were sufficiently novel and useful to be worthy of protection, as also the term of protection their merit and importance deserved; but I confidently believe that it is essential to the continued progress of the manufacturing industry of this country that inventors should enjoy some protection for their inventions, and without it we should infallibly lose much of our pre-eminence as a manufacturing nation."

"How is the inventor to 'reward himself?' The public would not pay him a fraction more whether he be the inventor or not, for the same thing that they can buy equally cheap elsewhere. Even if it were possible to keep any branch of manufacture secret when rivals have sufficient inducement to discover it, it is not to the advantage of the public that improvements should be concealed. Take the recent case of Mr. Perkins's discovery in aniline colours, which is of a nature that probably might have been kept secret with comparative ease. The publication of his process turned the attention of experimenters into the same direction, and kindred colours have since and in consequence been discovered by Medlock and others.

"Admitting fully that monopolies should only be given to an individual in the interests of the public, it is to their best interests that the inventor should be protected. The proper duration of that protection is a fair subject for discussion. It may be useful to vary it in different cases, but the object to be kept in view should be to offer such present advantages as will encourage the prosecution of experiments leading to discoveries, without afterwards granting a monopoly for so long a term as to cause an inconvenience to the public disproportionate to the good it has derived.

"A great deal is said of the selfishness of the ideal discoverer who, happening upon some improvement, churlishly exacts exorbitant toll for the use of it, or else insists upon burying his talent, and not being able himself to make it useful refuses to allow others to profit by it. Practically, discoveries are not made in this way. Trees of knowledge do not grow by the wayside, from which passers-by can gather fruit without an effort; and when a man has made a discovery, he is not likely to refuse a fair price for it. If he asks a high one and obtains it, his discovery must be worth the price, and therefore ought to have it. At the worst the nation is debarred for 14 years —not a long period in the life of a nation—from the use of that which otherwise would probably never have been communicated to it at all.

"It is said that inventors are of such a gushing nature, that without any such protection they would not refrain from communicating their discoveries to the world. Possibly this might be so when the discovery had been accomplished, and especially it may be true of essentially scientific discoveries, but I submit that the absence of the prospect of protection would most materially discourage that long course of laborious, minute, and persevering inquiry which forms the germ out of which—perhaps long after, and in other hands—flashes some brilliant development. The great discoverer is indebted, no one can say how far, to the humble, patient inquirers who have preceded him; they have sought the same end, though they may not have achieved the same success. He, perhaps, can afford to be content with his glory, but it was the hope of profit that prompted their labours and prepared the way for his brilliant discovery. Discourage them, and you cut away the foundation upon which he builds. All who have had experience in manufactures know the great amount of labour and perseverance necessary to make even the most trivial improvements; the endless experiments, disappointments, failures, and expense which precede success, and are too often never rewarded by it. Who would incur all this if he is to possess no property in the result should he have the good fortune to obtain a valuable one? And observe, he would not even be placed on the same footing as others; he would be at a great and positive disadvantage. He would have consumed time and money in elaborating his ideas; in other words, he would have expended capital upon which he ought to receive interest; his neighbours and rivals in pirating his invention could undersell him in it through having avoided any such outlay. Thus the original inventor would be more disadvantageously situated than any one else. Who then would be so foolish as to invent? It would be a temptation to manufacturers to make no exertions on their own parts, but to content themselves with pirating what others were doing.

"It is all very well to talk of manufacturers striving to improve for the love of the thing, and no doubt they take a proper pride in excelling in their several departments, but they are in business for the sake of profit, and consideration and profit form a fair and proper stimulus to excellence; of which the greatest possible is when improvements have arrived at such a point as to be of the nature of property some kind of limited monoply in them should be given.

"The arguments for the abolition of the patent laws are occasionally based upon the alleged interests of the inventor—*caveat inventor*—he is not compelled to avail himself of them, and at least he need not be provided with a grievance he does not feel. It is said that sometimes a meritorious invention is strangled in its birth because it is so hedged in with patents that it cannot move hand or foot. If these patents are valuable the public is advantaged, and can afford for a few years to dispense with the one new suggestion for the sake of the numerous successful existing ones; if they are valueless, their proprietors will be only too glad to accept some consideration for the use of that from which they have hitherto derived nothing but vexation and loss. If the new comer is such a weakly bantling that it cannot afford to pay for the use of existing patents it does not merit sympathy. I cannot understand why a patentee should be assumed to differ from other tradesmen; his royalties, like any other commodities, may be bought at a fair price.

"The cost of maintaining a patent at law is so considerable, and the risk of failure so great, that patentees usually prefer to enter into equitable compromise rather than embark in an expensive law suit, and very few but really valuable inventions are defended when attacked. The public, therefore, are not seriously hampered by the existence of valueless patents; and yet the hope of obtaining a profitable monopoly affords the greatest possible incentive to the enterprising inventors. Some inconvenience, too, might be risked to insure the great advantage of having new discoveries fully and fairly explained, instead of being kept as secret as possible, and eventually, perhaps, dying with the inventor. At the Manchester meeting of the Royal Association this subject was discussed, and an instance was given of the inconvenience occasionally experienced. The case was that of a railway company who suddenly bethought themselves that solid wheels to their carriages would be a good thing, but they found that they could not adopt the idea because some one had patented it a few years previously. This proves nothing except that if the railway company had availed themselves of the opportunity afforded them they might have adopted the improvement some years before it occurred to their own minds. If they could make no reasonable arrangements with the patentee for the present use of his invention they would not have to wait very long for the expiration of his patent.

"The present plan of prolonging patents for short periods is admirable; it weeds out the sickly and unprofitable patents. People at first are so sanguine of success that they will pay large amounts to secure a monopoly in their

inventions; but when year after year passes and brings them no profits, but plenty of outgoings, they become sick at heart and demur to pay further sums to prolong a patent which yields them nothing. It drops out of the way of succeeding discoverers, who may, however, obtain from it valuable hints and great assistance in perfecting their own inventions.

"Nearly every civilised nation has found it necessary to afford protection to inventors; and it seems in the interests of the community at large to be so important to do so, that I sincerely trust our present patent laws will not be repealed until efficient substitutes for them are devised."

The reply of the *Times* it as follows:—

"Mr. Pontifex misapprehends the effect of our remark that if patents were abolished the inventor would still have its priority and his secret; he could use his discovery, and, if publicity were a necessary consequence of use, the public should not be called upon to pay for what is in its nature incapable of appropriation. We were arguing against any supposed natural right of an inventor as the basis of our existing legislation, and, consistently with this view, proposed to leave him alone to make what use he could of his discovery. We are not called upon to interfere because use necessitates publicity. The point is that the State or community at present goes out of its way to make a bargain with an inventor. It says to every man, 'If you think you have made a discovery and will come and tell the world what it is, you shall, provided it is a discovery, have the exclusive use of it for fourteen years.' The offer is all on one side; if the man who believes he is an inventor thinks he can make more by keeping his secret, he never takes out a patent at all. The State voluntarily offers terms which may be accepted or refused on the part of the discoverer. No one would have a right to complain if the community receded from this position, and left inventors to take care of themselves. It is, in fact, a departure from the ordinary principle of non-interference in trade, to volunteer to create an exclusive right; and the burden of showing that this exception to the general rule is expedient rests upon the upholders of patents. It is in vain for them to talk of an abstract right in inventors to an exclusive use to their discoveries. There is no such thing; the inventor is no whit damnified if he is let alone, and it must be shown that it is to the advantage of the public to enter into such a compact with him as is involved in the existence of patents. This is the answer to the argument advanced by Mr. Pontifex, derived from the copyright of authors. It is quite true that the author can no more claim protection as of right than the inventor can; there is no such thing as copyright at common law; but it is evident that many arguments may be advanced in favour of the expediency of copyright in literature which are inapplicable to patent right in arts. It is, for example, a sound argument against the allowance of patents that the exclusive right given to a discoverer in April prevents a man who makes the same discovery by an independent process in May from using is own invention. It takes away his natural freedom of carrying out what he has innocently invented. This is a fact of constant occurrence in mechanics, but it would be ridiculous to suppose that it can be paralleled in literature. No two men ever invented the same book, and the copyright of one author cannot derogate from the rights of a second. Whether on the whole the arguments in favour of copyright are sound may, perhaps, be doubted. If Mr. Pontifex thinks them invalid, we shall not quarrel with him. It is no doubt true that the best works of literature, those which possess an immortal value, were written without the stimulus of copyright, and it is equally true that copyright does directly produce some baneful effects. But on whatever side the balance may incline on the question of copyright, it is clear that the arguments in support of it differ entirely from those in support of patents, and we are not driven, as Mr. Pontifex supposes, to the conclusion that copyright must be abolished because we believe patents to be unnecessary and inexpedient.

"The real question at issue is, why should the State go out of the way to invite mechanical and chymical inventors to make a bargain with it? What are the considerations which warrant this unusual action? In whose interest should it be maintained? Is it to the advantage of inventors themselves, or of the capitalists who work their inventions, or of the public at large, that a right of exclusive use should be given to the man who registers a discovery? We believe that on examination no one of these classes will be found to be benefited by the Patent Laws, and if this conclusion be correct the laws are at once condemned. It is, indeed, generally acknowledged that, whoever profits by Patent Laws, inventors do not. Take any one of the numerous mechanical discoveries which have been patented within the last 20 years and search out the history of the inventor. He will, in a vast majority of cases, be found to be a poor working engineer, employed in some great manufactory; as to the invention, it is not his property, he was compelled to sell the Patent almost before he obtained it, and he is lucky if, in spite of every sacrifice, he is not loaded with debts contracted in his efforts to perfect his machine. And if this be the case with a successful inventor, what can be said of the still more numerous class who are lured by false hopes into endless discoveries which are neither new nor true? The position of the capitalist manufacturer is not much better; whatever may be his trade, he is constantly exposed to the necessity of buying up one little Patent after another, or to find his improvements hampered because some trifling detail has been registered by a man with whom it is impossible to enter into a reasonable negotiation. Not unfrequently he has to suffer the mortification of discovering that the invention he has purchased from one man had been previously patented by another, and he has to buy it over again or stop his business. We believe that neither inventor nor capitalist reaps any real advantage from the existing law, and that the only persons who are benefited by it are the Patent agents and lawyers. The public at large are the real sufferers; they have to pay twice over for every proved invention, for they have to provide not only the honest rewards of capital and industry, but the costs of expensive lawsuits and abortive schemes.

"The defender of the Patent Laws will often confess that through their agency inventions cost the public more, but he contends, on the other hand, that without them no inventions at all would be perfected. Unfortunately for him reason and experience alike discredit his argument. The instinct of economy is too strong in man to require any inducement to call it into exercise. The principle of least action is a law of morals no less than of physics. Every man constantly endeavours for his own convenience to do his work with the least labour, and the saving of labour is prompted by the immediate, and not by the prospective, reward. Those who look upon the existence of Patent Laws as the necessary condition to an invention may be asked whether there were no inventions before patents were so much as dreamt of. The discoveries of printing and of gunpowder are two of the most important facts of modern history; but no exclusive rights prompted or rewarded their inventors. In our own day can it be said that the hope of commercial profit promoted the discovery of the electric telegraph? But it is unnecessary to refer to particular instances. There is a country of Europe, small in extent but one of the most famous in the inventive arts, the chosen home of many of the most delicate forms of mechanical industry—we mean Switzerland, where until recently, and for aught we know still, no Patent Law whatever existed. Discoveries were made there and inventions perfected in the interest of inventors themselves. Such an example dispels the notion that Patent Rights stimulate discovery, and disposes of the last argument of their advocate. The entire abolition of a system which does not benefit the inventor, which hampers the

producer, and taxes the purchaser, would, in the words of a great inventor, Sir Isambard Brunel, be 'an immense benefit to the country.' "

EXAMINATION PAPERS, 1864.

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in April last:—

(*Continued from page* 613.)

CHEMISTRY.

THREE HOURS ALLOWED.

No candidate is allowed to answer more than three questions in each division.

FIRST DIVISION.

1. What loss of weight will 300 grains of oxide of copper undergo by heating to redness, in contact with 5 grains of hydrogen? What weight of water will be formed?
2. How is nitric acid most conveniently prepared on a mall scale? What are its commonest impurities, and how are they detected?
3. How is chlorate of potash usually prepared? How much oxygen is contained in a pound of the salt?
4. By what process is sulphur for the most part removed from coal gas? What compound of sulphur remains in the gas after the partial purification?
5. How is silica detected in minerals? How separated from water?
6. Explain by symbols the action of sulphuric acid on bone-earth. Also, the action of ammonia on superphosphate of lime.

SECOND DIVISION.

1. In what reaction does tin resemble arsenic and antimony? How is it separated from those metals?
2. Explain, by an equation, the action of nitric acid on metallic copper. Also, that of sulphuric acid on metallic mercury.
3. How would you analyse brass?
4. How is alumina detected in presence of chromic oxide?
5. How is magnesium prepared? Describe its chief properties.
6. Describe the manufacture of soda, and name ist chief impurities, and explain how you would test for each of them.

THIRD DIVISION.

1. Describe and explain the process of sugar boiling and also that of sugar refining.
2. How is acetic acid prepared from wood? How is acetic acid distinguished from formic acid? How is anhydrous acetic acid prepared?
3. To what family of compounds does the essential oil of bitter almonds belong? How is it purified?
4. What is the action of litharge and water on olive oil? Give the formula of some of the proximate constituents of the oil?
5. How is lactic acid most conveniently prepared in large quantities? What is its composition? Describe one or two of its salts.
6. What are the chief constituents of opium? Describe their preparation and properties.

ANIMAL PHYSIOLOGY.

THREE HOURS ALLOWED.

1. Describe the microscopic structural elements found in the blood of man. What other animals besides man possess a true blood? In what respect does the blood of such animals differ from or resemble human blood microscopically?
2. Give an account of the coagulation of the blood, of the attendant changes in that fluid, of the influences which accelerate, retard, or prevent it, and of the chief theories concerning the nature and cause of that process. Does coagulation occur in the living body, and if so, what uses may it serve?
3. Name the chief proximate constituents of animal and vegetable food and drink; describe their general sources and characters, and give their ultimate chemical composition.
4. Mention some illustrations of the destination of the several proximate constituents of food and drink in the animal economy; and explain, on general principles, the command man possesses of regulating the condition of his body by the use of special kinds of food.
5. Give a physiological explanation of the way in which drowning causes death. What is the condition physiologically of a person apparently dead from recent immersion in the water? What are the special objects to be aimed at for his recovery; and what might a non-professional person do immediately for the attainment of those objects?
6. Name and describe that part of the eyeball which receives and is excited by luminous impressions. What circumstances are calculated to preserve its functions unimpaired, and what may weaken or destroy it.

BOTANY.

THREE HOURS ALLOWED.

The Candidate is expected to answer correctly four questions in Section I. and six questions in Section II.; Nos. 8, 9, *and* 10 *of the latter each standing for an answer.*

SECTION I.—VEGETABLE PHYSIOLOGY.

1. Explain the general nature of the chemical changes which take place during *germination.* By what conditions are the changes determined?
2. In what what way are the functions of plants grown in glass houses liable to be affected by *nocturnal radiation?* How may its ill effects be obviated?
3. What functions are liable to be interfered with by *transplanting?* Explain this interference and how it may be guarded against.
4. What is the *micropyle?* What relation does it bear to the *radicle?* And, in the two principal types of ovule, to the *hilum?*
5. What is meant by a *spurious dissepiment?*
6. What part do *oils* play in vegetable economy? Where are they usually found? Name three genera, belonging to different Natural Orders, affording oil for economic uses.

SECTION II.—PRACTICAL BOTANY.

1. Describe the structure and theoretical composition of the *column* of the flower of an *Orchis.*
2. Explain the morphological change in the so-called *double flowers* of *Rose, Tulip,* and *Dahlia.*
3. Describe the principal modifications of the fruit in British genera of *Rosaceae* (including *Pomaceæ, Drupaceæ, Roseæ,* and *Sanguisorbeæ*).
4. What peculiarities distinguish (1) the structure of the *wood,* (2) the form and arrangement of the *leaves,* (3) the structure of the *pollen,* and (4) the structure of the *female flower* of *Pines?*
5. Give the diagnostic characters of the Natural Order *Cucurbitaceæ.*
6. How does wheat (*Triticum*) differ from rye (*Secale*)?
7. Name the *Genus* and *Natural Order* to which the plants marked A, B, C, D, respectively belong, with reasons for your opinion.

8, 9, 10. Describe the three plants marked A, B, and C, strictly in accordance with the form given in "Descriptive Botany," chap. vii.

AGRICULTURE.

THREE HOURS ALLOWED.

I.

1. How is the fertility of the soil increased by (*a*) drainage, (*b*) tillage, (*c*) liming, and (*d*) rest in clover and grass, respectively?

2. Describe the drainage of a clay-field on a uniform and gentle slope, stating the probable depth, direction, and interval of drain you would adopt, and the probable cost per acre you would incur.

3. Name the operations in their order by which you would conduct the autumn cultivation of a foul wheat stubble.

4. Describe the operation of liming, naming the proper time for it in rotation, the proper quantity to apply per acre, and the time and mode of application.

II.

5. Name three or four commonly-adopted rotations of crops, and state the circumstances for which each is specially adapted.

6. State the dressings of manure generally applied per acre to the commonly-cultivated crops of the farm.

7. Describe the cultivation of the potatoe and of peas, relating the proper previous cultivation of the land, the sorts selected, the seed time, cultivation during growth, harvesting, and produce per acre.

8. What is the proper treatment, in order to its improvement, of a poor and foul pasture?

III.

9. Describe shortly the breeding and rearing of (*a*) cattle, (*b*) sheep, and (*c*) swine.

10. What quantity of mutton are you likely to make of 50 acres (say 800 tons) of swedish turnips, 6 tons of linseed cake, and 12 tons of good hay?

11. What is the ordinary cost to the farmer of the following operations:—(*a*) ploughing, (*b*) harrowing, (*c*) rolling, (*d*) mowing clover, (*e*) hoeing wheat, (*f*) hoeing and singling turnips, (*g*) cutting and harvesting wheat (*h*) per acre, and threshing and cleaning wheat, oats, and barley per quarter, respectively?

12. What amount of capital is needed on a farm of 1,000 acres of light soil (cultivated on the 4-course system of crops), under the following heads:—(*a*) rent and rates —30s. per acre, (*b*) labour, (*c*) seed and manure, (*d*) working cattle and implements, (*e*) live stock?

(*To be continued.*)

Fine Arts.

Stained Glass Competition.—The Committee of Council on Education desire to obtain for the South Kensington Museum a design for a stained glass window, having a northern light, with semicircular head, and of the following dimensions—viz., 18 feet 9 inches high to crown of arch, by 11 feet wide. The window may be seen on a staircase at the north-west corner of the Great Northern Court. The architectural decorations of the staircase will be of an Italian Renaissance character. The subject of the design is furnished by the 38th chapter of Ecclesiasticus, verse 24 to the end of the chapter. The design is to be on the scale of one inch to the foot, and coloured. It is to be accompanied by a full-size cartoon of the design of a sufficient portion to show the execution, and a specimen of a portion of the design executed in glass, of the full size. The competition is open to artists of all nations. A sum of £40 will be awarded for the design which appears to be most suitable, and a sum of £20 for the next best design. The judges will be instructed to award the prizes to the designs solely upon artistic merits, without reference to the probable cost of execution. Each design must be accompanied by a sealed tender, stating the cost at which the design can be executed, the time the execution is likely to take, and the name and address of the artist. The designs and tenders must be sent to the South Kensington Museum on or before the 1st May, 1865. The names of the judges will be published hereafter. The designs to which the prizes are awarded will become the property of the Department, which, however, does not bind itself to execute either of them.

Fine Arts in France.—The distribution of decorations and medals to those artists to whom the prizes were awarded by the jury of the late annual exhibition of works of art in Paris took place on the 13th instant, under the presidency of Marshal Vaillant, Minister of the Imperial Household and of the Fine Arts, who was supported by M. Nieuwerkerke and the other officers of state attached to the department of the Beaux Arts. For some years this ceremony has taken place in the Palais de l'Industrie, where the exhibitions are held, but upon the present occasion the artistic concourse was called together in the *grand salon carré* of the Louvre, the estrade being erected in front of the "Assumption" of Murillo, and facing the great work of Paul Veronese, the "Marriage of Cana in Galilee." The propriety of this famous salon, the walls of which are covered with the *chef d'œuvres* of art, as compared with the bare, cold galleries of the Palais de l'Industrie, for such a ceremony, is self-evident. The proceedings seemed animated by the presence of the *genius loci;* and the recipients of the honours awarded must have felt that they were crowned in the presence of great painters of the past, whose works hung around, and which still are the admiration, the wonder, and the despair of the artists and amateurs of our time. In addition to the medals awarded, and of which notice appeared in the *Journal of the Society of Arts* in May last, the painter Cabanel and the sculptor Clesniger were made officers of the Legion of Honour, and four other French painters, one engraver, a sculptor, and an architect, received the cross of chevalier. Three foreign painters received like distinctions, M. Willems being promoted from chevalier to officer of the legion; and M. Hamman, a Belgian, and M. Achenbach, of Düsseldorf, being nominated chevaliers. On the occasion of the last exhibition, no painting was found worthy of the grand prize, and in sculpture the great medal was awarded to a deceased artist, for what he had done in previous years—"a posthumous honour laid upon his tomb." This is, of course, unsatisfactory to the artistic world, and, moreover, many of the best artists have of late refrained from exhibiting their works. With the view to improve the tone of the exhibitions, and to give further encouragement to men of genius and talent, the Emperor announced, through his minister, at this meeting, that he had created a new stimulus, under the name of the Emperor's Grand Prize, of the value of 100,000 francs (£4,000), to be awarded once in five years to any work in painting, sculpture, or architecture which may be considered worthy of such honour. This great prize is to be at the disposition of a commission, presided over by the Minister of the Fine Arts, and consisting of thirty members, of whom six are to be of the Academy. This prize will only be awarded to French artists, and it will be awarded for the first time in 1869.

Delacroix Exhibition.—The collective exhibition of the works of Eugène Delacroix was thrown open, as announced, on the 13th instant, to a select number of visitors, and on the following day to the public. It cannot be said that it exhibits fairly the genius of the artist—this must be looked for in the ceilings of the Louvre, the Hôtel de Ville, and other great public buildings; but, as a collection of his pictures and sketches, if not complete, it is highly satisfactory, and, with some few exceptions, the works are seen to advantage. The catalogue, which is carefully printed, and gives the name of the proprietor of each work, together with its dimensions, but unaccountably omits the dates of the works in almost all cases, contains more than

two hundred and thirty entries. The most important works are, the two large pictures, the "Battle of Taillebourg" and the "Taking of Constantinople," with the portrait of Marshal Tourville, from Versailles; "Algerian Women in their Apartments," "A Jewish Wedding in Morocco," "The 28th July, 1830," "A Scene from the Massacres of Scio," and the "Dante and Virgil" from the Luxembourg; the "Battle of Nancy," from the gallery of that town; "A Morocco Chief visiting a Tribe," from the Nantes museum; "Christ on the Mount of Olives," from the church of St. Paul and St. Louis, Paris; "Arabian Musicians and Buffoons," from the museum of Tours; "Marcus Aurelius on his Death-bed," from Lyons; and the "Emperor Justinian composing his Laws," from the Chamber of Conseil d'Etat, Paris. The great mass of the works of Delacroix are in the hands of amateurs, his special admirers. Thus, the Baron de Laage contributes nine, M. Aroza, eight, M. Haro, twenty-nine, and Bourruet twelve works, without calculating drawings and sketches. A remarkable work, "Tasso in the Madhouse," is contributed by M. Alexandre Dumas, fils; another, "A Young Woman combing her hair," with a demon grinning behind the mirror in which she regards herself, by M. Auguste Vacquerie. Another notable work is the "Combat between Byron's Pacha and Giaour," the property of M. Malher. As regards the sketches and drawings, their interest is diminished by the fact of their having been seen so recently at the sale of the artist's works, but those who did not see that extraordinary collection will be well repaid by a visit to the present exhibition. Foremost amongst the works of this class is the small pencil sketch known as the "Education of Achilles," the future hero learning the use of his bow and arrow on the back of a centaur, which Delacroix specially named in his will to be offered for sale by public auction, and which fetched the enormous sum of 2,500 francs (£100). In the gallery is a bust of Eugène Delacroix, recently executed by M. Carrier-Belleuse; it is full of character, and will doubtless become popular. Altogether, the Delacroix exhibition on the Boulevard des Italiens will be a great attraction for those who have any artistic taste, and who may visit Paris this autumn.

SALE OF PICTURES.—The works of art of the late M. Sherbette, deputy, was disposed of the other day by public auction. The collection contained some works by old and rather rare masters, but the connoisseurs were away from Paris, and the prices realised were low, in some cases excessively so. A "Holy Family," by Breemberg (1659), went for £15; "Horses in a Stable," by Géricault, for less than £7; a pair of pendants by Guido Reni, subjects "Astronomy" and "Poetry," the former represented by a young female, with her arms resting on a globe; the latter by St. Cecilia holding a lyre, were sold for £45. A clever painting by Jean le Duc, "A Concert of Amateurs," went for little more than £10; "Cows in a Field, near a Village," signed Paulus Potter, 1648, fetched nearly £16; "The Martyrdom of St. Victor," represented in sixteen compositions, painted on panel by the Gothic School of Cologne, realised £56. Besides the pictures there were a few sketches. A marine sketch, by Copley Fielding, which went for 58 francs; two drawings of horses, by Géricault, which produced 333 francs; a pencil sketch of horses by Carl Vernet, sold for 130 francs, and others of less importance.

RUBENS'S CHEFS-D'ŒUVRE.—Those who pay a visit this autumn to the church of Notre Dame at Antwerp will have the opportunity, for the first time, of judging fairly of the two grand paintings, the "Crucifixion" and the "Descent from the Cross." These magnificent works were, heretofore, not only placed out of the range of ordinary vision, but the *volets*, or wings, were placed in such a manner as to throw false shadows on the central compositions. M. Durlet, the architect, has now removed the pictures to a lower position, and has placed the three portions of each subject in the same plane. This should have been done long since, but "better late than never."

Manufactures.

PETROLEUM OILS.—The following instructions, relating to the use of these oils for lighting purposes in Paris, have been approved by the Préfect of the Seine and published:—As there is danger in the use of petroleum oils, it is important that the public should be made acquainted with the precautions by which this may be avoided. Petroleum, properly purified, is almost colourless. The litre should weigh not less than 800 grammes. It should not at once take fire on being brought into contact with a lighted body. This essential condition may be easily tested: a small quantity of the oil should be poured into a saucer and the surface touched with a lighted match. If the petroleum has been deprived of the light and very inflammable oils, it will not only not take fire if a lighted match be thrown into it, but the match itself, after burning for an instant, will be extinguished. All mineral oils, intended for lighting purposes, which will not stand this test should be rejected as extremely dangerous. Petroleum oil, even when deprived of the very light spirit, called naphtha, which renders it inflammable in contact with flame, is, nevertheless, one of the most inflammable materials known. If poured on linen cloth or woollen fabrics its inflammability is greatly increased, and great care is needed in its storing and sale. It should be kept or carried in metal vessels only, and the stores where it is placed should be lighted either by outside lamps or safety lamps. A lamp for burning petroleum and this class of oils must have no cracks or flaws in the parts surrounding the wick. The receptacle for the oil should be sufficiently large to hold more than enough oil for each burning, so that the lamp may not become empty whilst burning. Transparent receptacles, such as glass or porcelain, are to be preferred, as the quantity of oil contained may be seen. The receptacle should be thick, and the adjustments should be fixed on it, not merely by tight fitting, but by means of some cement not affected by the mineral oil. The stand of the lamp should be heavy, and with a broad base, to ensure steadiness and render it less liable to be upset. Before lighting a lamp it should be completely filled and then carefully closed. When the oil is nearly come to an end the lamp should be extinguished and allowed to cool before it is opened for refilling. In case, however, it is necessary to fill the lamp before it is quite cool, it is absolutely essential to keep carefully at a distance any light which may be wanted during the operation. If the glass of the lamp breaks, it should be extinguished at once, to prevent the heating of the fittings, for such a heating may be sufficiently intense to vaporize the oil in the receptacle; the vapour may take fire, ending in an explosion destroying the lamp and scattering in all directions a liquid at all times inflammable and frequently in an inflamed state. The best materials for extinguishing these oils when burning are sand, earth, and ashes, and very superior to water. In case of burns, and before the arrival of a medical man, it will be found useful to keep the wounded part covered with linen rags kept continually moistened with water.

Commerce.

PATTERN AND SAMPLE POST.—The following is an outline of the modifications recently made in the regulations:—On and after the 1st of September next, the following will be the regulations of the Inland Pattern and Sample Post, viz.:—"1. The rates of postage will be reduced by one-third at each step in the scale of charge, and will be: For a packet of patterns or samples not exceeding 4 oz. in weight, 2d.; exceeding 4 oz. but not exceeding 8 oz. in weight, 4d.; exceeding 8 oz. but not exceeding 16 oz. in weight, 8d.; exceeding 16 oz. but not exceeding 24 oz. in weight, 1s. 2. The postage must be

paid by stamps. 3. No packet of patterns or samples must exceed 24 oz. in weight. 4. The patterns or samples must not be of intrinsic value. 5. There must be no writing or printing, in addition to the address of the person for whom the packet is intended, except the address of the sender, a trade mark and numbers, and the prices of the articles; otherwise the packet will be treated as a letter. 6. There must be no enclosure other than the samples themselves. The particulars which are allowed to be furnished under the preceding rule must in all cases be given, not on loose pieces of paper, but on small labels attached to the samples or the bags containing them. 7. The patterns or samples must be sent in covers open at the ends, so as to be easy of examination. Samples, however, of seeds, &c., may be enclosed in boxes made of cardboard, or in bags of linen or other material fastened in such a manner that they may be readily opened. Bags so closed that they cannot be readily opened, even although they be transparent, must not be used for this purpose. 8. If a packet of patterns or samples be posted altogether unpaid, it will be charged with double the postage which should have been prepaid. If a portion of the postage be prepaid, even although only a penny stamp be affixed, the packet will be charged with the amount of the deficiency, together with an additional rate of twopence. 9. In order to prevent any interruption to the regular transmission of letters, a packet of patterns or samples may, when it is necessary, be kept back for twenty-four hours. 10. The rule which forbids the transmission through the post of any article which might injure the contents of the mail bags or the officers of the Post Office is so far relaxed as to permit the transmission of scissors, knives, razors, forks, steel-pens, nails, keys, watch machinery, metal tubing, pieces of metal or ore, and such like, as samples, provided that they be packed and guarded in so secure a manner as to afford complete protection to the contents of the mail bag and the officers of the Post Office, while at the same time the samples may be easily examined; and provided also that such samples as might be in themselves of intrinsic value are rendered unsaleable by being slightly damaged before they are posted. 11. Information as to the best modes of packing the articles named in the preceding clause may be obtained at the secretary's office, General Post Office, London. 12. The preceding regulations do not affect the transmission of patterns or samples beyond the United Kingdom. The rules and rates of postage of the Pattern Post between this country and various colonies and foreign countries remain unaltered.

Obituary.

Professor Ferrier, of St. Andrews, was born in Edinburgh on the 16th of June, 1808, and died on the 11th July, 1864, being thus nearly 65 years of age. His father was John Ferrier, W.S., one of Sir Walter Scott's brother clerks of session, and his mother was Margaret Wilson, a sister of Professor Wilson, the chief of the early brilliant staff of *Blackwood's Magazine*, and well known to the literary world as Christopher North. His aunt by the father's side, Miss Susan E. Ferrier, was the authoress of three novels that still keep their ground with the public, namely, "Marriage," "The Inheritance," and "Destiny." His mind grew and opened up in this literary atmosphere. As a boy he had been amused by the pen-and-ink caricatures of Lockhart, "The Scorpion who delighteth to sting the faces of men," and astonished by witch stories told by Hogg, "The Ettrick Shepherd." His scholastic education was begun under Dr. Duncan, minister of Ruthwell, an earnest classical scholar. It was continued under Dr. Burney, of Greenwich, and afterwards at the Universities of Edinburgh and Oxford, at the latter of which he took the degree of B.A. He gained the prize for the best poem in the Moral Philosophy Class in Edinburgh, and his verses are still remembered by his contemporaries at Oxford, one of whom was Sir Roundell Palmer, the present Attorney-General. In 1832 he, like most of the young aspirants to literature in Edinburgh, entered the Faculty of Advocates. His family connection with lawyers secured him a fair amount of junior counsel practice; but he did not care for forensic work and legal hair-splitting, and his most industrious hours were spent over metaphysical and general literature. In 1837 he married his cousin Margaret, Professor Wilson's eldest daughter, who inherited not a little of her father's wit and talent. In 1838-39 he contributed to *Blackwood's Magazine* a series of papers on the "Philosophy of Consciousness," written in a popular and poetical style, and characterised by great acuteness, eloquence, and ingenuity. He was elected Professor of Universal History in the University of Edinburgh by his brethren of the Faculty of Advocates, who were patrons in 1842, and in the session of 1844-45 he read Sir William Hamilton's lectures on "Logic and Metaphysics," occasionally entertaining the students by speculations of his own, expressed in a more flowing style than Sir William's lectures, and illuminated by the enthusiasm of youth and faith. In 1845, under the strong recommendation of Sir William Hamilton, Sir E. Bulwer Lytton, and many others distinguished in literature, he was appointed to the Chair of Moral Philosophy in the University of St. Andrews, which office he held to his death. This chair was formerly held by Dr. Chalmers, the great pulpit orator of Scotland. When his father-in-law, Professor Wilson, in 1852, through failing health, resigned the Edinburgh Moral Philosophy Chair he became a candidate for it, but was unsuccessful. He was again a candidate to the same patrons, when Sir W. Hamilton's chair fell vacant through death, in 1856, and was again defeated. It was thought that his not being a "Free Churchman" militated against his success in both these cases. Another probable cause was, that he had edited a republication of Professor Wilson's "*Noctes Ambrosianæ*" in the text of which several leading whigs and littérateurs were attacked. In the interval between these two unsuccessful canvasses for Edinburgh chairs, besides editing the popular edition of his father-in-law's works, he prepared for the press his "Institutes of Metaphysic; a Theory of Knowing and Being," which was published in 1854. For two or three years previously he had been teaching the doctrines of it to his class, and he had the ideas pretty thoroughly thought out before he began to write, and long occasional passages quite finished, but the general expression of the bulk of it was dashed off *currente calamo*, and scarcely altered afterwards. For ease, perspicuity, variety, elegance, delicate lights and shades, and the glow of poetry, the style of the work has perhaps hardly any parallel in English philosophical literature. It has almost the subtle lucidity of Berkeley or Hume, with a humour nearly equal to that of the latter, and more poetry than either, and a strength of idealistic faith not inferior to that of Berkeley, to whom Pope ascribed "Every virtue under heaven." No historical portrait so closely resembles Professor Ferrier as that of Bishop Berkeley, in Trinity College, Dublin. Upon his tall, spare figure, and beautiful classic face, nature herself had set the impress of philosopher and gentleman. Among his lectures there were some valuable expositions of the history of philosophy, and some curious disquisitions on the affinity of philosophy and poetry, which it is hoped will yet be given to the world. He succeeded the present Archbishop of York as Examiner in "Logic and Mental Science" to the Society of Arts.

Monsieur Hachette.—On the 2nd of August took place in Paris the funeral of one well known in the literary world, and whose labours for forty years have exercised considerable influence on the advancement of mental culture. M. Hachette, the celebrated publisher, was born at Réthel (Ardennes), in the year 1800. At 19 years of age he entered the Ecole Normale, which he quitted in 1822, at the time of taking his degree. The

beginning of his fortunes, so brilliant in the future, was of a modest character. He commenced his industrial career with one single work, *Le Traité de Versification Latine*, by M. Quicherat, his fellow pupil, but he gradually ventured further, exhibiting great skill and tact in carrying on his undertakings. He may be said to have done more in the production of classical works than any other man of his age. His activity, however, was not limited to such works as these alone, but embraced literary works of all kinds. He died at the age of 64, leaving an enormous business, well established on the firmest foundations, which now rests in the hands of his sons and sons-in-law, who, by following in the footsteps of their father, cannot fail to render the business one of the largest of its kind in the world. M. Hachette was followed to the grave by men of note of all classes, his son, M. George Hachette, and his sons-in-law, MM. Templier and Breton, attending as chief mourners.

Publications Issued.

The Linen Trade, Ancient and Modern. By Alexander J. Warden, Merchant of Dundee. (*Longmans and Co.*) The author, in his preface, states that the object of his book is to supply a want that has long existed,—a comprehensive history of so important and ancient a manufacture as that of linen and the commerce connected with it. The work is dedicated, by permission, to the Chamber of Commerce of Dundee, to the directors of which, as well as to other individuals, he considers himself much indebted for information and for facilities in the consultation of many works connected with the subject. The author commences by treating of the various raw materials employed, discussing the cultivation of flax, hemp, jute, and various other fibres, and giving the statistics of the trade in them. He then enters upon the linen of the ancients, the Bible linen, the linen of the Egyptians, the Phœnicians, the Grecians, and the Romans. In Section 3 is given the substance of some popular lectures, prepared by Mr. W. Miller, of Dundee, and delivered by that gentleman to audiences in that place. The author then passes on to the modern linen trade, taking first the continental, embracing the Italian, Spanish, German, Dutch, French, Russian, Chinese, American trade, and then entering upon that of the United Kingdom, divided under the heads of English, Irish, and Scotch, tracing the history of the trade from its commencement down to the present time, with copious statistics derived from the Board of Trade, and other available sources. The writer concludes his book with a short and popular description of the various manufacturing operations connected with the different materials employed. In doing this there is no attempt to make his volume a handbook to practical manufacturers —that was foreign to the object of the work, and would indeed have been impossible without drawings. The treatment of so complicated a subject would require a volume to itself.

Coffee and Chicory, their culture, chemical composition, preparation for market and consumption, with simple tests for detecting adulteration, and practical hints for the producer and consumer, by P. L. Simmonds, author of the "Commercial Products of the Vegetable Kingdom," "A Dictionary of Trade Products," &c., with numerous illustrations (*E. and F. N. Spon*).—In this handbook the fullest descriptive and statistical details are given respecting the introduction and progress of the culture of coffee in every producing country. Precise details as to supply and consumption are also given; and a large amount of chemical research as to the composition of various coffees, and the distinguishing characteristics of the different commercial varieties of berries are furnished. There are ten good woodcuts, illustrating the plant, scenery of plantations in the east and west, buildings, pulping machinery, &c.

Notes.

Safety in Railway Trains.—The Board of Trade has issued a circular to the various railway companies, saying that they have had under their consideration the complaints, frequently urged on their attention, of the danger existing or apprehended from the want of means of communication between the different portions of a railway train while in motion, and are desirous of calling the attention of railway companies to this subject, with a view to the consideration how far, by means of increased facilities for communication between different portions of a railway train while in motion, or other improved regulations, it may be practicable to obviate the evils complained of. The circular goes on to say:—"Several expedients have been suggested as calculated in some degree to further the desired object. One expedient for guarding against offences in railway carriages, which has been proposed is that of placing windows between the compartments of each carriage. As these windows might be provided with curtains, the privacy of the carriages need not ordinarily be interfered with. As an expedient for providing means of communication between the guard and the passengers, it has been suggested that every vehicle forming part of a passenger train should be furnished with footboards and handrails, which would admit of the guard (or, in case of emergency, other persons) passing along the train. It appears to my lords deserving of consideration whether this expedient, guarded, of course, by carefully-framed regulations, to prevent abuse, might not be generally adopted with very beneficial effects. The use of a cord running along the train, by means of which the guard can attract the attention of the engine driver, has now existed on some lines so long as to prove that there is no difficulty in its application." In conclusion, the Board ask for the opinion of the directors as to the practical value of arrangements of the nature specified, and invite any suggestions which the directors may think adapted to accomplish the ends in view; particularly desiring to be informed whether, with a view to the application of such means to the carriages of one company passing on the line of another company, any regulations of a general and compulsory character are deemed expedient.

To Correspondents.

Erratum.—In the last number, paragraph 6, page 620, for "31st February," read "28th February."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par.
Numb. *Delivered on 18th and 19th July*, 1864.

406. Casual Poor—Regulations, &c.
463. Civil Contingencies Fund—Accounts.
484. Income Tax (Ireland)—Return.
201. Bills—Criminal Justice Act (1855) Extension (amended).
202. „ Westminster Bridge Traffic.
206. „ Bank Notes, &c., Signature.
208. „ Facilities for Divine Service in Collegiate Schools.
209. „ Clerk of the Peace Removal.
210. „ Salmon Fisheries (Scotland) Acts Amendment.
211. „ Bank Post Bills (Ireland).
213. „ Indian Medical Service.
214. „ Corn Accounts and Returns.
215. „ West Indian Incumbered Estates Act Amendment.
217. „ Exchequer Bonds (£1,600,000).
218. „ Fortifications (Provision for Expenses).
219. „ Metropolis Management Act (1862) Amendment.

Denmark and Germany—Correspondence (1858).
Denmark and Germany (No. 7)—Correspondence (1864).

Delivered on 19th July, 1864.

405. National Education (Ireland)—Return.
409. Soldiers and Police—Return.
491. Public Income and Expenditure—Account for the year ended 30th June, 1864.

492 Metropolitan Improvements—Return.
212. Bills—Contagious Diseases (amended).
220. ,, Cathedral Minor Corporations.
North America (No. 16)—Further Papers respecting the arrest and imprisonment of Mr. James McHugh.
North America (No. 17)—Correspondence respecting the enlistment of British Subjects.

Delivered on 20th July, 1864.

431. Cattle Diseases Prevention and Importation Bills—Report.
467. Convict Prison Dietaries—Report.
488. Bankruptcy—Return.
489. Bankruptcy—Returns.
221. Bills—Private Bill Costs.
222. ,, Poor Removal.
223. ,, Defence Act Amendment.
224. ,, Poor Relief (Metropolis).
225. ,, Stamp Duties Act (1864) Amendment.
Colonial Possessions (Past and Present State) (Part I.)—Reports.

Delivered on 21st July, 1864.

339. East India (Engineers' Establishment, &c.)—Returns.
457. Gas Companies (Metropolis)—Accounts.
478. West India Incumbered Estates Acts—Circular Despatch, Memorial, Correspondence, &c.
505. East India (Paper Currency, &c.)—Papers and Correspondence.
226. Bills—Pilotage Order Confirmation (No. 2) (amended).
227. ,, Bribery at Elections.
228. ,, Civil Bill Courts (Ireland) (Lords Amendments).
229. ,, Portsea Island (Rights of Way).
Defence of Spithead—Report of a Special Committee.

Delivered on 22nd July, 1864.

480. Kitchen and Refreshment Rooms (House of Commons)—Second Report from the Select Committee.
485. East India (Medical Service)—Despatch.
502. Redundant List (Public Departments)—Return.
511. Japan—Despatch.
230. Bill—Titles (Ireland).

Delivered on 23rd and 25th July, 1864.

383 (I). Turnpike Trusts—Index to Report.
468. Education (Inspectors' Reports)—Report of Committee, &c.
507 (A). Poor Rates and Pauperism—Return (A), April, 1863 and 1864.
510. Standing Orders Revision—Report.
510 (I). Standing Orders Revision—Report and Evidence.
231. Bills—Mutual Surrender of Criminals (Prussia).
232. ,, Masters and Servants.
233. ,, Naval Discipline.
Defence of Spithead—Plan to accompany Report.
Public General Acts—Cap. 39 to 46.

Delivered on 26th July, 1864.

283. Population, Electors, &c.—Returns.
443. Manchester Parish—Official Correspondence.
473. Turnpike Trusts—Returns.
496. Dockyards—Second Report from the Select Committee.
503. Saltpetre (Calcutta)—Account.
506. Constables' Fees (Tunbridge Wells)—Return.
508. Civil List Pensions—List.
Railways in India—Report for the years 1863-64, by J. Danvers, Esq.

Delivered on 27th July, 1864.

343. East India (Bengal Military Fund)—Correspondence.
522. Estimates for Civil Services (1864-5)—General Abstract.

Delivered on 28th July, 1864.

234. Highways Act Amendment Bill—Lords Amendments.
235. Railways Construction Facilities Bill—Lords Amendments.
236. Railway Companies' Powers Bill—Lords Amendments.
239. Contagious Diseases Bill—Lords Amendments.
240. Thames Conservancy Bill—Lords Amendments.
238. Improvement of Land Act (1864) Bill—Reasons assigned by the Lords for disagreeing to certain Amendments made by the Commons.
520. Bankruptcy—Return.
Public General Acts—Cap. 47 to 72.

Delivered on 29th July, 1864.

517. Vagrants, &c. (Paddington, &c.)—Returns.
521. Supply and Ways and Means (Session 1864)—Return.
523. Friendly Societies (Scotland)—Report.
539. Municipal Boroughs (Ireland)—Abstract of Statement.
482. Captain Melville White—Return.
235. Bills—Railways Construction Facilities—Lords Amendments.
241. ,, Pier and Harbour Orders Confirmation—Lords Amendments.
242. ,, Courts of Conciliation.

Patents.

From Commissioners of Patents Journal, August 5th.

GRANTS OF PROVISIONAL PROTECTION.

Steam boilers, indicating the density of the water used in—1770—J. Saunders.
Steel, manufacture of—1876—J. P. Chambeyron.
Stirrups—1819—W. E. Gedge.
Sub-marine foundations, &c.—1854—T. B. Heathorn.
Sugar funnels or moulds—1855—T. Dixon.
Twist lace machines—1790—S. Whitehurst.
Valves—1834—G. Stevenson.
Washing machine—1812—J. Coton.
Water, cleansing or clarifying—1688—W. E. Newton.
Water wheels, construction of—1768—J. G. Tongue.
Window curtains, arranging and actuating—1843—J. Fraser.
Window sill and window garden, combined—1845—J. Bell.
Windows, apparatus for shutting—1878—C. W. Standish.
Woollen fabrics, drying and stretching—1861—A. Wydler.
Writing, apparatus for—1685—G. Murray.

From Commissioners of Patents Journal, August 12th.

Artificial fuel, manufacture of—1907—R. A. Brooman.
Bedsteads, &c., metallic—1935—E. Cooke.
Boilers, preventing incrustations in—1864—W. Irwin.
Buttons, construction and fastenings of—1730—C. de Wailly.
Buttons, shanks for—1911—P. C. Sassé.
Chimney-pots, construction of—1903—G. Carter.
Copper ore, smelting of—1506—P. Spence and H. D. Pochin.
Cotton gins, &c., rollers for—1901—T. Bourne.
Cotton, rollers used in preparing, spinning, &c.—1917—R. Kay, J. Manock, and G. Dakin.
Drags, &c., adjusting the load contained in—1905—P. H. Moore.
Flax, breaking and stamping—1927—E. Warry.
Floor cloth, manufacture of—1921—S. Hawksworth.
Fire-arms, ascertaining the distance therefrom of objects to be fired at—1887—J. Cope.
Fire-arms, breech-loading—1895—T. Wilson.
Hides, tanning of—1706—T. Sharp.
Horses, apparatus for breaking—1881—J. Newsome.
Iron and steel, preventing oxydation of—1875—J. P. Chambeyron.
Knickerbocker tissues, formation of yarn for—1899—E. Schischkar and C. G. Speyer.
Liquids, apparatus for drawing off—1933—A. Bain.
Liquids, apparatus for measuring—1897—J. F. Hearsey.
Mashing apparatus—1931—C. Garton and T. Hill.
Pocket perfume fountain—1891—P. E. Fontenay.
Railway carriages, &c., arrangements for stopping—1893—J. Long.
Railway carriages, signalling between passengers and guards—1929—W. T. W. Jones.
Railway trains, direct communication between guards and passengers of—1853—G. Lansdown.
Rifled ordnance, projectiles for—1856—B. Britten.
Sewing machines—1923—A. Smith.
Shafts and girders, manufacture of—1831—C. Sanderson.
Ships, propelling and steering—1925—J. H. Johnson.
Shot, shells, &c.—1772—J. McG. Croft.
Spinning and doubling, self-acting mules for—1808—C. Whittaker and J. Cocker.
Textile fabrics, apparatus for finishing—1879—S. Hiley.
Umbrellas and sun-shades—1761—W. White.
Washing machine—1883—H. Moon.
Window blinds, rollers of—1909—J. Everard.

From Commissioners of Patents Journal, August 16th.

PATENTS SEALED.

399. F. C. P. Hoffmann.	453. J. Howard, J. Bullough, and T. Watson.
401. J. and M. Deavin, and J. H. Sutton.	467. C. Esplin.
402. J. A. Lloyd.	470. T. Rowatt, jun., and A. Lighbody.
406. E. Moore.	472. J. F. Rivier.
407. H. A. Jowett.	490. F. Ransome.
408. H. Newmane.	495. J. M. Worrall & S. Cooper.
419. J. Travis.	505. S. Cooper & J. M. Worrall.
420. R. C., R. J., and J. E. Ransome.	520. W. Noton.
423. W. Hickling.	523. E. F. Pastor, jun.
425. E. Butterworth.	535. H. Bennison.
426. J. B. Jude.	550. M. Henry.
432. F. J. Arnold.	576. E. Cowles.
437. W. Hale.	584. J. P. Worrall.
439. E. E. Allen.	589. T. Greenwood & H. Hadley.
442. F. R. Mosley.	647. C. Anderson.
444. W. Brookes.	670. P. A. L. de Fontainemoreau.
447. G. P. Gee and W. H. Gosling.	1048. F. Bush.
448. J. Drabble.	1242. J. Hamilton, jun.
449. J. Oldknow and J. Wood.	1457. J. Grant.
	1603. W. E. Gedge.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1990. R. A. Godwin.	2102. W. Baines.
1991. A. F. B. Falgas.	2220. T. Greenwood.
356. T. W. Rammell.	2009. J. Jacob.
1997. A. Barclay.	2038. C. W. Kesselmeyer and T. Mellodew.
2053. W. Bennett.	2032. J. C. Martin.
2002. W. E. Gedge.	
2039. J. Combe.	

Registered Designs.

Blind pulley—4639—Caldicott and Collins, Birmingham.
Match-box or holder for suspending against a wall—4640—Jno. Hadley, 3, Royal-terrace, Norwood, S.
A shooting jacket and vest—4641—Jno. Q. Bird, 13, Regent-street, W.
A metallic necktie fastener or scarf ring—4642—Hall and Dutson, Birmingham.
A candle and grease guard—4643—Jas. Richd. Greaves, 524, New Oxford-street.